GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT (GITAM)

(Deemed to be University)

VISAKHAPATNAM * HYDERABAD * BENGALURU

Accredited by NAAC with A^{++} Grade

GITAM School of Science

CURRICULUM AND SYLLABUS

4 Year Undergraduate Programme
UCHEM04: B.Sc. Chemistry

w.e.f. 2024-25 admitted batch

(Updated on July 2025)

Academic Regulations

Applicable for the Undergraduate Programmes in the Schools of Business (except B.Com.), Humanities & Social Sciences and Science (except B.Sc.(CSCS), B.Optometry, B.C.A)

https://www.gitam.edu/academics/academic-regulations

GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT

Vision

GITAM will be an exceptional knowledge-driven institution advancing on a culture of honesty and compassion to make a difference to the world.

Mission

- Build a dynamic application-oriented education ecosystem immersed in holistic development.
- Nurture valuable futures with global perspectives for our students by helping them find their ikigai.
- Drive impactful integrated research programmes to generate new knowledge, guided by integrity, collaboration, and entrepreneurial spirit.
- Permeate a culture of kindness within GITAM, fostering passionate contributors.

Quality Policy

To achieve global standards and excellence in teaching, research, and consultancy by creating an environment in which the faculty and students share a passion for creating, sharing and applying knowledge to continuously improve the quality of education.

GITAM School of Science

Vision

To nurture outstanding Science Education and build a vibrant world-class research and innovation ecosystem.

Mission

1. To provide a flexible, responsive, and adaptive curriculum that emphasizes experiential learning and allows students to realize their full potential.
2. To develop high-impact research knowledge and solutions to improve the communities in which we live.
3. To promote a culture of high curiosity, enterprising mindset and keen desire to contribute to society.
4. To inculcate empathy, integrity, and trust in the GITAM fraternity with a strong commitment towards society and environment.

VISION AND MISSION OF THE DEPARTMENT

VISION

To Spread Knowledge and excel in academics in Chemical Education with cutting-edge research and innovation by creating a collaborative and active learning-based educational system

MISSION

- To teach the most renewed curriculum to match the industrial requirements
- To conduct advanced research for enriching the learning skills of students
- To address major challenges in thrust areas of research like Drug Development, Material Science, Health, Energy, Environment and Space.

Programme Educational Objectives (PEOs)

PEO 1: GU Chemistry graduates will be well prepared for successful careers in the profession at an industry and/or in government in one or more of discipline of chemistry.

PEO 2: GU Chemistry graduates will be academically prepared to become licensed professional chemists in due course and will contribute effectively in serving the society.

PEO 3: GU Chemistry graduates will be engaged in professional activities to enhance their own achievement and simultaneously contribute in service of humankind.

PEO 4: GU Chemistry graduates will be successful in higher education in Chemistry

PEO 5: GU Chemistry graduates will provide leadership quality to work in all kinds of circumstances, diverse environment such as interdisciplinary and multidisciplinary learning systems.

PEO Articulation

	PEO1	PEO2	PEO3	PEO4	PEO5
M1	2	2	2	2	2
M2	3	2	3	1	3
M3	2	3	2	1	2
M4	2	3	3	2	2

3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

UCHEM04: B.Sc. Chemistry

Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

At the end of the Programme the students would be able to demonstrate:

PO1: Complex problem-solving:
- To solve different kinds of problems in familiar and non-familiar contexts and apply the learning to real-life situations.

PO2: Critical thinking:
- Apply analytic thought to a body of knowledge, including the analysis and evaluation of policies, and practices, as well as evidence, arguments, claims, beliefs, and the reliability and relevance of evidence.
- Identify relevant assumptions or implications and formulate coherent arguments.
- Identify logical flaws and holes in the arguments of others.
- Analyze and synthesize data from a variety of sources and draw valid conclusions and support them with evidence and examples.

PO3: Creativity:
- Create, perform, or think in different and diverse ways about the same objects or scenarios.
- Deal with problems and situations that do not have simple solutions.
- Innovate and perform tasks in a better manner.
- View a problem or a situation from multiple perspectives.
- Think 'out of the box' and generate solutions to complex problems in unfamiliar contexts.
- Adopt innovative, imaginative, lateral thinking, interpersonal skills and emotional intelligence.

PO4: Communication Skills:
- Listen carefully, read texts and research papers analytically and present complex information in a clear and concise manner to different groups / audiences.
- Express thoughts and ideas effectively in writing and orally and communicate with others using appropriate media.
- Confidently share views and express herself / himself.
- Construct logical arguments using correct technical language related to a field of learning, work/vocation, or an area of professional practice, and convey ideas, thoughts, and arguments using language that is respectful and sensitive to gender and other minority groups.

PO5: Analytical reasoning/thinking:
- Evaluate the reliability and relevance of evidence.
- Identify logical flaws in the arguments of others.
- Analyze and synthesize data from a variety of sources-draw valid conclusions and support them with evidence and examples, and address opposing viewpoints.

PO6: Research-related skills:
- A keen sense of observation, inquiry, and capability for asking relevant/ appropriate questions.
- The ability to problematize, synthesize, and articulate issues and design research proposals.
- The ability to define problems, formulate appropriate and relevant research questions, formulate hypotheses, test hypotheses using quantitative and qualitative data, establish hypotheses, make inferences based on the analysis and interpretation of data, and predict cause-and-effect relationships.

- The capacity to develop appropriate methodology and tools for data collection.
- The appropriate use of statistical and other analytical tools and techniques.
- The ability to plan, execute and report the results of an experiment or investigation, the ability to acquire the understanding of basic research ethics and skills in practicing/doing ethics in the field/ in personal research work, regardless of the funding authority or field of study.

PO7: Coordinating/collaborating with others:

- Work effectively and respectfully with diverse teams.
- Facilitate cooperative or coordinated effort on the part of a group.
- Act together as a group or a team in the interests of a common cause and work efficiently as a member of a team.

PO8: Leadership readiness/qualities:

- Mapping out the tasks of a team or an organization and setting direction.
- Formulating an inspiring vision and building a team that can help achieve the vision, motivating and inspiring team members to engage with that vision.
- Using management skills to guide people to the right destination.

PO9: Learning how to learn skills:

- Acquire new knowledge and skills, including 'learning how to learn skills, that are necessary for pursuing learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social, and cultural objectives, and adapting to changing trades and demands of the workplace, including adapting to the changes in work processes in the context of the fourth industrial revolution, through knowledge / skill development / re-skilling.
- Work independently; identify appropriate resources required for further learning.
- Acquire organizational skills and time management to set self-defined goals and targets with timelines.
- Inculcate a healthy attitude to be a lifelong learner.

PO10: Digital and technological skills:

- Use ICT in a variety of learning and work situations.
- Access, evaluate, and use a variety of relevant information sources, and use appropriate software for analysis of data.

PO11: Multicultural competence and inclusive spirit:

- The acquisition of knowledge of the values and beliefs of multiple cultures and a global perspective to honour diversity.
- Capability to effectively engage in a multicultural group/society and interact respectfully with diverse groups.
- Capability to lead a diverse team to accomplish common group tasks and goals.
- Gender sensitivity and adopting a gender-neutral approach, as also empathy for the less advantaged and the differently-abled including those with learning disabilities.

PO12: Value inculcation:

- Embrace and practice constitutional, humanistic, ethical, and moral values in life, including universal human values of truth, righteous conduct, peace, love, non-violence, scientific temper, citizenship values.
- Practice responsible global citizenship required for responding to contemporary global challenges, enabling learners to become aware of and understand global issues and to become active promoters of more peaceful, tolerant, inclusive, secure, and sustainable societies.
- Formulate a position/argument about an ethical issue from multiple perspectives.
- Identify ethical issues related to work, and follow ethical practices, including avoiding unethical behavior such as fabrication, falsification or misrepresentation of data, or committing plagiarism, and adhering to intellectual property rights.
- Recognize environmental and sustainability issues and participate in actions to promote sustainable development.
- Adopt an objective, unbiased, and truthful actions in all aspects of work.

- Instill integrity and identify ethical issues related to work, and follow ethical practices.

PO13: Autonomy, responsibility, and accountability:

- Apply knowledge, understanding, and/or skills with an appropriate degree of independence relevant to the level of the qualification.
- Work independently, identify appropriate resources required for a project, and manage a project through to completion.
- Exercise responsibility and demonstrate accountability in applying knowledge and/or skills in work and/or learning contexts appropriate for the level of the qualification, including ensuring safety and security at workplaces.

PO14: Environmental awareness and action:

- Ability to apply the knowledge, skills, attitudes, and values required to take appropriate actions for.
- Mitigating the effects of environmental degradation, climate change, and pollution.
- Effective waste management, conservation of biological diversity, management of biological resources and biodiversity, forest and wildlife conservation, and sustainable development and living.

PO15: Community engagement and service:

- To participate in community-engaged services/ activities for promoting the wellbeing of society.

PO16: Empathy:

- To identify with or understand the perspective, experiences, or points of view of another individual or group, and to identify and understand other people's emotions.

PSO1: Acquire knowledge of the concepts of core Chemistry and interdisciplinary subjects to excel in theoretical and experimental Chemistry.

PSO2: The aptitude to employ emerging methods and techniques for problem-solving across diverse domains within the field of Chemical sciences and to develop Entrepreneurship.

PSO3: Acquire research-oriented learning that develops analytical and integrative problem-solving approaches.

PSO4: Gain analytical and logical skills required for higher Education/Academics/ Industry and to solve the real-life problems.

Curriculum Structure

(Flexible Credit System)

Minimum Credit Requirements to Award Degree Under Each Category

S.No.	Course Category and Category Code		Minimum Credit Requirement					
			3 Year Undergraduate		4 Year Undergraduate (Hons.)		4 Year Undergraduate (Hons.) with Research	
			Credits	(%)	Credits	(%)	Credits	(%)
1	Multidisciplinary Core Courses	MDC	12	9.83	12	7.41	12	7.41
2	Major Core	MC	42	34.43	74	45.68	62	38.27
3	Major Electives	ME	18	14.75	18	11.11	18	11.11
4	Minor	MI	24	19.67	32	19.75	32	19.75
5	Internship	INT	04	3.28	04	2.47	04	2.47
6	Ability Enhancement Courses – University Core	UC	10	8.20	10	6.17	10	6.17
7	Skill Enhancement Courses – University Core	UC	08	6.56	08	4.94	08	4.94
8	Value Added Courses – University Core	UC	04	3.28	04	2.47	04	2.47
9	Research Project / Dissertation	PROJ	--	00	--	00	12	7.41
	Total		**122**	**100**	**162**	**100**	**162**	**100**

Multi-disciplinary Core Courses (MDC): 12 credits

Course Code	Level	Course Title	L	T	P	S	J	C
Basket - Business (Minimum 4 credits)								
HRMG1012	100	Principles of Management	2	0	0	0	0	2
IENT1061	100	Introduction to Business Environment	2	0	0	0	0	2
INFS1011	100	Technology and Business	2	0	0	0	0	2
STGM1011	100	Introduction to Business Organization	2	0	0	0	0	2
Basket - Humanities and Social Sciences (Minimum 4 Credits)								
SOCY1071	100	Introduction to the Humanities	2	0	0	0	0	2
SOCY1081	100	Foundations of Social Sciences	2	0	0	0	0	2
MSTU1081	100	Media and Communication (Offered in Hyderabad Campus alone)	2	0	0	0	0	2
FPEA1221	100	Performing Arts in Indian Cinema	2	0	0	0	0	2
LANG1261	100	The Art of Storytelling	2	0	0	0	0	2
Basket - Science (Minimum 4 Credits)								
PHYS1371	100	Introduction to Astronomy and Astrophysics	2	0	0	0	0	2
LFSC1001	100	Essentials of Life Processes	2	0	0	0	0	2
LFSC1011	100	Fundamentals of Natural and Chemical Sciences	2	0	0	0	0	2
MATH1371	100	Conceptual Mathematics	2	0	0	0	0	2
CSCI1341	100	Fundamentals of Computer Science	2	0	0	0	0	2
Total Credits								**12**

Major Core (MC): 42 credits

Course Code	Level	Course Title	L	T	P	S	J	C
CHEM1062	100	Inorganic Chemistry – I	3	0	2	0	0	4
CHEM2022	200	Inorganic Chemistry – II	3	0	2	0	0	4
CHEM1101	100	Analytical Chemistry -I	3	0	2	0	0	4
CHEM2191	200	Analytical Chemistry – II	3	0	2	0	0	4
CHEM2201	200	Physical Chemistry-I	3	0	2	0	0	4
CHEM2042	200	Physical Chemistry-II	3	0	0	0	0	3
CHEM2002	200	Organic Chemistry – I	3	0	2	0	0	4
CHEM3002	300	Organic Chemistry – II	3	0	2	0	0	4
CHEM3101	300	Molecular Spectroscopy	3	0	0	0	0	3
CHEM3111	300	Spectroscopic Analysis of Organic Compounds	3	0	0	0	0	3
CHEM3121	300	Computational Chemistry	2	0	2	0	0	3
CHEM3131	300	Chemistry of Natural Products and Pharmaceutical Chemistry	2	0	0	0	0	2
		Total Credits						42

Major Electives (ME): 18 credits

Minimum number of credits to be earned: 18.

Course Code	Level	Course Title	L	T	P	S	J	C
CHEM2211	200	Advanced Engineering Chemistry	3	0	2	0	0	4
CHEM2221	200	Essentials of Engineering Chemistry	3	0	2	0	0	4
CHEM2231	200	Chemical Aspects of Engineering Materials	3	0	2	0	0	4
CHEM2241	200	Application of Chemistry in Electronics	3	0	0	0	0	3
CHEM2251	200	Nanoscience and Nanotechnology	3	0	0	0	0	3
CHEM2261	200	Chemical Analysis of Agricultural Materials	3	0	0	0	0	3
CHEM2271	200	Biomolecules, Drugs and Pesticides	3	0	0	0	0	3
CHEM2281	200	Thermodynamics and ionic equilibrium	3	0	2	0	0	4
CHEM2291	200	Molecules of Life	3	0	2	0	0	4
CHEM2301	200	Instrumental Methods of Chemical Analysis	3	0	0	0	0	3
CHEM2311	200	Industrial Chemicals and Environment	3	0	0	0	0	3
CHEM2321	200	Chemistry of Pollutants, Cement and Fuels	3	0	0	0	0	3
CHEM2331	200	Materials and Nanochemistry	3	0	0	0	0	3
CHEM2341	200	Introduction to Quantum Chemistry on Quantum Computer	3	0	0	0	0	3
CHEM3072	300	Chemistry of Materials	3	0	0	0	0	3
CHEM3141	300	Industrial Chemistry	2	0	2	0	0	3
CHEM3151	300	Polymer Chemistry	2	0	2	0	0	3
CHEM3161	300	Chemistry of Biomolecules	3	0	0	0	0	3
CHEM3171	300	Physical Organic Chemistry	3	0	0	0	0	3
CHEM3181	300	Chemical Dynamics	3	0	0	0	0	3
CHEM3191	300	Statistical Thermodynamics	3	0	0	0	0	3
CHEM3201	300	Physical Methods in Inorganic Chemistry	3	0	0	0	0	3
CHEM3211	300	Supramolecular Chemistry	3	0	2	0	0	4
CHEM3221	300	Basics of Nanochemistry and Applications	3	0	0	0	0	3

Internship (INT): 4 credits

Course code	Level	Course Title	L	T	P	S	J	C
CHEM3444	300	Internship	0	0	0	0	8	4

University Core (UC): 22 credits

Course code	Level	Course Title	L	T	P	S	J	C
Ability Enhancement Courses								
LANG1042	100	Academic Writing	2	0	0	0	0	2
LANG1201	100	Critical Thinking	2	0	0	0	0	2
IENT1051	100	Fundamentals of Entrepreneurship	2	0	0	0	0	2
LANG1241	100	Communicative English - I	0	0	4	0	0	2
LANG1251	100	Communicative English - II	0	0	4	0	0	2
Skill Enhancement Courses								
CSCI1302	100	Introduction to Programming	0	0	4	0	0	2
CSCI1312	100	Introduction to Data Science	0	0	4	0	0	2
CLAD1041	100	Art of Persuasive Communication	0	0	2	0	0	1
GCGC1051	100	Professional Communication and Analytical Skills Development	0	0	2	0	0	1
GCGC1061	100	Applied Communication and Aptitude Skills	0	0	2	0	0	1
GCGC1071	100	Preparation for Campus Placements	0	0	2	0	0	1
Value Added Courses								
ENVS1003	100	Environmental Studies *	3	0	0	0	0	3
POLS1051	100	The Indian Constitution *	1	0	0	0	0	1
Pass / Fail Courses (Mandatory)								
FINA1081	100	Personal Financial Planning *	1	0	0	0	0	1
PHPY1011	100	Gandhi and the Contemporary World * / UHV	1	0	0	0	0	1
Pass / Fail Courses (Any one course to be chosen)								
DOSP1181	100	Yogasana	0	0	0	2	0	1
MFST1002	100	Health and Wellbeing *	0	0	2	0	0	1
DOSL1081	100	Student Life Activities (Participant)	0	0	0	2	0	1
DOSL1091	100	Student Life Activities (Organizer)	0	0	0	2	0	1
DOSL1101	100	Student Life Activities (Competitor)	0	0	0	2	0	1
DOSL1111	100	Foundations of Student (Leadership)	0	0	0	2	0	1
DOSL1042	100	Community Services – Volunteer	0	0	2	0	0	1
DOSL1052	100	Community Services – Mobilizer	0	0	2	0	0	1
DOSP1003	100	Badminton	0	0	0	2	0	1
DOSP1033	100	Football	0	0	0	2	0	1
DOSP1043	100	Volleyball	0	0	0	2	0	1
DOSP1053	100	Kabaddi	0	0	0	2	0	1
DOSP1073	100	Table Tennis	0	0	0	2	0	1
DOSP1083	100	Handball	0	0	0	2	0	1
DOSP1093	100	Basketball	0	0	0	2	0	1
DOSP1113	100	Throw ball	0	0	0	2	0	1
DOSP1142	100	Cricket	0	0	0	2	0	1
DOSP1132	100	Functional Fitness	0	0	0	2	0	1
DOSP1171	100	Martial Arts/Self Defence	0	0	0	2	0	1

* Massive Open Online Course (MOOC)

Students pursuing 4th year of the Programme need to choose the courses from the respective basket of Honours or Honours with Research

Honours Courses

Minimum number of credits to be earned: 32.

Course Code	Level	Course Title	L	T	P	S	J	C
CHEM4001	400	Advanced Inorganic Chemistry-1	3	0	2	0	0	4
CHEM4011	400	Advanced Organic Chemistry -1	3	0	2	0	0	4
CHEM4021	400	Advanced Physical Chemistry -1	3	0	2	0	0	4
CHEM4031	400	Advanced Analytical Chemistry -1	3	0	2	0	0	4
Electives (Any four)								
CHEM4041	400	Advanced Inorganic Chemistry-2	3	0	2	0	0	4
CHEM4051	400	Advanced Organic Chemistry-2	3	0	2	0	0	4
CHEM4061	400	Advanced Physical Chemistry-2	3	0	2	0	0	4
CHEM4071	400	Advanced Analytical Chemistry-2	3	0	2	0	0	4
CHEM4081	400	Medicinal Chemistry	3	0	2	0	0	4
CHEM4091	400	Unit Operations in Chemical Engineering	3	0	0	0	0	3
CHEM4101	400	Industrial Safety, Chemical Technology and Society	3	1	0	0	0	4
CHEM4111	400	Modeling and Drug Design	3	0	2	0	0	4
CHEM4121	400	Application of Computer in Chemistry	3	0	2	0	0	4
CHEM4131	400	Regulatory affairs and Quality assurance	3	1	0	0	0	4
CHEM4141	400	Industrial Chemicals and the Environment	3	0	2	0	0	4
CHEM4151	400	Nuclear Chemistry	3	0	0	0	0	3

Honours with Research Courses

Minimum number of credits to be earned is 32 out of which 12 credits must be earned through Research Project / Dissertation

Course Code	Level	Course Title	L	T	P	S	J	C
Any 5 of the following courses								
CHEM4001	400	Advanced Inorganic Chemistry-1	3	0	2	0	0	4
CHEM4011	400	Advanced Organic Chemistry -1	3	0	2	0	0	4
CHEM4021	400	Advanced Physical Chemistry -1	3	0	2	0	0	4
CHEM4031	400	Advanced Analytical Chemistry -1	3	0	2	0	0	4
CHEM4041	400	Advanced Inorganic Chemistry-2	3	0	2	0	0	4
CHEM4051	400	Advanced Organic Chemistry-2	3	0	2	0	0	4
CHEM4061	400	Advanced Physical Chemistry-2	3	0	2	0	0	4
CHEM4071	400	Advanced Analytical Chemistry-2	3	0	2	0	0	4
CHEM4081	400	Medicinal Chemistry	3	0	2	0	0	4
CHEM4091	400	Unit Operations in Chemical Engineering	3	0	0	0	0	3
CHEM4101	400	Industrial Safety, Chemical Technology and Society	3	1	0	0	0	4
CHEM4111	400	Modeling and Drug Design	3	0	2	0	0	4
CHEM4121	400	Application of Computer in Chemistry	3	0	2	0	0	4
CHEM4131	400	Regulatory affairs and Quality assurance	3	1	0	0	0	4
CHEM4141	400	Industrial Chemicals and the Environment	3	0	2	0	0	4
CHEM4151	400	Nuclear Chemistry	3	0	0	0	0	3
Research Project / Dissertation (PROJ)								
CHEM4888	400	Dissertation - I (Review of Literature & Research Proposal)	0	0	0	0	8	4
CHEM4999	400	Dissertation – II	0	0	0	0	16	8

Minor Courses

One Minor is to be chosen from the following list of Minors.
The minimum number of credits to be earned up to 3 years of the programme is 24.
The minimum number of credits to be earned for the 4 years programme is 32.

Minors List

S.No.	Minor	Offered by School	Credits Required	
			3-Year UG	4-Year UG
1	Business Analytics (Except for GSB)	Business	24	32
2	Business Management (Except for GSB)	Business	24	32
3	Financial Markets (Except for GSB)	Business	24	32
4	Psychology	Humanities	24	32
5	Economics	Humanities	24	32
6	English	Humanities	24	32
7	Bharatanatyam	Humanities	24	32
8	Carnatic Vocal	Humanities	24	32
9	Choreography and Screen Dance	Humanities	24	32
10	Kuchipudi	Humanities	24	32
11	Mohiniyattam	Humanities	24	32
12	Mridangam	Humanities	24	32
13	Theatre Arts	Humanities	24	32
14	Visual Arts	Humanities	24	32
15	History	Humanities	24	32
16	Mass communication (Hyd)	Humanities	24	32
17	Visual Communication (Hyd)	Humanities	24	32
18	Sociology	Humanities	24	32
19	Political Science	Humanities	24	32
20	Public Policy (Hyd)	Public Policy	24	32
21	Chemistry	Science	24	32
22	Data Science	Science	24	32
23	Biochemistry	Science	24	32
24	Bioinformatics	Science	24	32
25	Biotechnology	Science	24	32
26	Environmental Management	Science	24	32
27	Environmental Science	Science	24	32
28	Microbiology	Science	24	32
29	Food Science and Technology	Science	24	32
30	Mathematics	Science	24	32
31	Statistics	Science	24	32
32	Atmospheric Physics	Science	24	32
33	Climate Science	Science	24	32
34	Electronics	Science	24	32
35	Physics	Science	24	32
36	Quantum Computing	Science	24	32
37	Computer Science	Technology	24	32
38	Data Analytics	Technology	24	32
39	Machine Learning	Technology	24	32

GITAM School of Science

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